CHAPTER-I

1.1 Introduction

Human beings are habitually dependent on plants. Different plant components have been used by human beings from ancient times as food products, daily health care and for beauty care products. The medicinal properties of various plants have provided significant contribution in the development of maximum traditional herbal therapies.

Human beings are continuously striving to achieve the highest level of perfection and are ever poignant to new results and innovation. The health of humans has continuously captured the attention of scientists, researchers etc on account of infliction of chronic, non communicable diseases like heart disease, cancers of various organs, diabetes and obesity. World Health Organization reports has highlighted that more than 75% of mortality are due to the chronic diseases occurring in the lower and middle income groups of undeveloped countries. 60% of such incidences are aged between 18 and 64. It has usually been the financially and weak people that are more prone to chronic diseases because of malnutrition and increased exposure to infections and lower access to health care [1].

Medicinal plants are the chief source of medically important therapeutic agents. From ancient times, medicinal plants have been used in health care and drug. Systemic chemical analyses of these plants lead to the development of bioactive molecules resulting in the development of novel drugs. Recently, there is a growing interest in the pharmacological screening of various plants used in different traditional system of medicine. In last few decades, many of traditionally known plants have been screened by advanced scientific techniques and accredited for various medicinal properties. It has been reported that use of plants originated products for the prevention and treatment of different pathologies is continuously growing throughout the world and medicinal plants are gifts of nature to cure limitless number of diseases among human beings [2].

The World Health Organization describes that tobacco use, decreasing physical activity, and increasing consumption of unhealthy foods are major cause for chronic disease and are responsible for decreasing life span. Today it is most important challenge to identify significantly the factors which influence the human health and initiate chronic disease however, research on plants play an important role in addressing this imposing challenge which can lead to the identification of new metabolites those reduce the risk of chronic disease. Research on plants can also lead to the development of tools which characterize the health-promoting effects of these plant metabolites. Plant based foods produce beneficial component for maintaining good human health and can contribute significantly to reduce the social and economic burdens of curing chronic disease
globally [1]. Medicinal plants have been used around the world to treat a wide range of disorders, mainly in developing countries and primitive cultures.

A good number of people living in developing and underdeveloped countries are still dependent on plant-based traditional medicinal system for prevention and treatment of diseases [4]. Plant-based food materials play an important role in healthy diet of human beings which is supported by evolutionary opinion put forward by human genome-related research. Such foods rich in leafy vegetables, cereals, lentils, and fruits have low starch and fats contents but rich in proteins. Food originated from plants have good nutritional value to improve immune system and protect health from different diseases. The individual constituents of plants which promote health are difficult to be identified. Research in the area of plant biochemistry may lead to recognition, qualitative, and quantitative analysis of secondary metabolites in plant-based foods predominantly recognized to encourage good health [1].

Today plants are essential need for human beings because they are important sources of different basic requirements for survival. Plants are known to produce useful compounds like oils, resins, tannins, natural rubber, gums, waxes, dyes, poisons, drugs, flavours, and fragrances, pharmaceuticals, and pesticides [5]. Plants originated drugs are used for treatment of different diseases without damaging cellular and metabolic systems of human beings. Various plants based products like dietary fiber, phenolic acids, flavonoids, vitamins, antimicrobial agents, and neuropharmacological agents are used in different applications and play a protective role against some common diseases like cancer, cardiovascular, and neurodegenerative disorders [6-7].

According to the pharmacological and chemical investigation, medicinal plants revealed the presence of the active constituents and their effect on the human and animal body systems. Indian indigenous medicinal practices based on the use of medicinal plants have been accrued through centuries and such plants are still valued even today [8]. Nature provides a magnificent opportunity for discovery of new drug molecules because of the large chemical biodiversity of terrestrial and aquatic plants and animals. Hence, interest has again been evolved to look into natural product chemistry. Traditional medicinal knowledge is gaining impetus to look for newer molecules having therapeutic values [9]. Although synthetic drugs are gaining momentum these days but natural plant-based drugs remain valued for their medicinal and pharmacological importance. The discovery of new drugs such as Taxol (antitumor, also known as Paclitaxel) and Artimisinin (antimalarial) from higher plants are among few examples [10-11].

About 119 drugs commonly used are extracted from plants [12]. Green plants represent a rich pool of chemo-therapeutants and also valuable sources of botanical pesticides. Edible wild indigenous plants become an alternative source of food with high potential of vitamins, minerals
and others interesting elements particularly during seasonal food shortage. The use of plant based essential oils and phytochemicals, both having known antibacterial properties, is of great consequence. In the past few years, investigations have been conducted worldwide to prove antimicrobial, antioxidant, anti-inflammatory, cytotoxic, antinociceptive and anti-malarial behavior of plant based essential oils [13-15]. It is recorded and documented that based on ethno pharmacology clues as many as 74% of the pharmacologically active biomolecule have been derived from natural sources [16]. A survey of United Nations conference revealed that 33% of the total drug originated from plant species (plants and microbes) and more then 55% medicinal products originated naturally [17].

1.2 Essential oils

Chemically, essential oils are a combination of several organic substances, such as C_5H_8 unit known as isoprene unit and straight–chain compounds. The essential oils can be isolated by the steam and hydro-distillation of aromatic plants. The essential oils are mixture odiferous compounds having oily in nature and can be obtained from different plant parts like flowers, leaves, barks, woods, roots, rhizomes, fruits, and seeds. They are used by the cosmetic, food and pharmaceutical industries. The constituents of essential oils are used as food preservative, additives and natural remedies for the treatment of various illnesses and have been claimed to have cured organ dysfunction or systemic disorders [18-20]. Essential oils have smaller molecules, ordinarily less than twenty carbon atoms. They have a characteristics aromatic fragrance due to their volatilization on contact with air and they can be extracted easily without any change in their chemical composition. Essential oils have a variety of industrial applications because of their high volatility and odor; they are used in the manufacture of perfumes, soaps etc. and have various applications as medicines. Cedar wood oil, which has a high refractive index, is used as mounting medium with oil-immersion lenses in microscopy. Eucalyptus oil is used in floatation process for separation of minerals from their ores [21]. It has been reported that plants are the richest source of phytochemicals, bioactive photochemicals and safe antioxidant compounds and also play an important role in the food preservation and pharmacological industries [22]. They are used in most developing countries, as a normative basis for the maintenance of good health, has been widely observed [23].

1.3 Antioxidant properties

Although oxygen is essential for cell growth it also generates several reactive oxygen radicals. Thus respiration for normal function of human body also leads to formation of oxygen radicals which are responsible for various diseases. Antioxidants play an important role in detoxification of these radicals and are known as radical scavenger. However many radical scavengers has been reported for their antioxidant properties and there is essential needs to search
for natural and safe radical scavengers which are reduce the oxidative stress effect. Superoxide anion radicals, hydroxyl radicals and non free radicals species such as hydrogen peroxide are active oxygen radical [24]. Reactive oxygen species are responsible for peroxidation of membrane lipids and denaturation of nucleic acids and proteins [25-26]. Antioxidant compound from plants incorporated in human diet can protect the human body from degenerative effect of free radical and reactive oxygen species. They slow down the development of many chronic diseases. Extensive efforts are needed to identify alternative natural and safe antioxidant for human welfare [27].

The uses of fresh fruits and vegetables in diets have been advocated for health benefits and prevention of chronic diseases because of presence of antioxidants compounds in diet. This beneficial effect is believed to be due to, at least partially, the action of antioxidant compounds, which reduce oxidative damage in the body [28]. Endogenous free radical and other highly reactive species are commonly referred to as reactive oxygen species (ROS). These reactive species are generated endogenously in many basic biochemical processes of the body like respiration. Reactive oxygen species (ROS) generation is a normal process during normal cell metabolism, in living beings. Large amount of ROS leads to oxidative stress followed by oxidative DNA damage which is responsible in etiology and pathogenesis of health disorders, like cardiovascular, atherosclerosis, reperfusion injury, cataractogenesis, rheumatoid arthritis, inflammatory disorders and cancer [29-30].

Researchers have shown a great deal of interest in natural antioxidants especially those with plant origin because of their relatively low side effects. Plant originated drugs or medicines are safer and have fewer side effects in comparison to the synthetic drugs. Many important medicines have been derived from plant and have been used for the treatment of many diseases. The starting molecules like digoxin/digitoxin, the vinca alkaloids, reserpine, taxol and tubocurarine are some important examples [31]. However, plant constituents are used as therapeutic agents, and as lead molecules for the synthesis of drug molecules [32]. Wild fruits are also known to have nutritional and medicinal properties that can be attributed to their antioxidant effects and they can be used to fortify staple foods particularly for malnourished children and it has already been reported for their anti-bacterial activity [33]. Many pharmacological activities of plant extracts and essential oils have already been studied. Anti-fungal and anti-inflammatory activities have been reported from the methanolic extract as well as from the essential oil of Wedelia chinensis (Osbeck) [34].

1.4 Objective of the study

Himalayan region is a big repository of medicinal and aromatic plants, which gives ample opportunity to explore the fauna of this region for their medicinal uses and value addition. Little work on pharmacological activity and chemical composition of family Lamiaceae and Verbenaceae
is reported. Hence it was considered of interest to screen the plants from family Lamiaceae and Verbenaceae growing in this region for their biological, pharmacological activity and chemical composition. The objectives of the work to be carried out are outlined as below:
1. To collect plant materials from various locations under study
2. To extract essential oils from aerial parts (leaves/seeds and fruits).
3. To prepare samples of plant material
4. To Analyse extracted essential oils
5. To study composition of essential oils
6. To evaluate various pharmacological properties
7. To estimate total phenols, dihydric phenols and flavonols of extracts
8. To Analyse and interpretation of data

1.5 Organization of the Thesis

This thesis has been devoted to determine the medicinal importance and therapeutical standards of selected indigenous herbs, *Thymus linearis* Benth. *Micromeria biflora* (Buch.- Ham ex D. Don) Benth and *Callicarpa macrophylla* Vahl. that thrive in the Kumaun region of Uttarakhand. Further evaluation has been carried out to support the medicinal applications of the selected herbs. The Thesis is divided into six Chapters including the present chapter of introduction.

**Chapter II** presents the review of literature on the different aspects of the plants *Thymus linearias*, *Micromeria biflora* and *Callicarpa macrophylla* relevant to the research problem.

**Chapter III** describes the study sites, plant materials, chemicals, isolation of essential oil and hydro-alcoholic extracts, yield of extracts. Chapter III include different methods of selected pharmacological activities research methodology used for the objective no.1 to 8 and it also includes information related to the collection of the Plant material and its identification.

**Chapter IV** describes the results and deals the description of results of computation of essential oil composition along with physical analysis of essential oils and makes a comparative discussion on findings with earlier reports.

**Chapter V** describes the antioxidant activity of essential oils and extracts as well as biochemical assay determined in term of total phenols, flavonols and orthodihydric phenols with results and discussions,

**Chapter VI** illustrates the results and discussions of pharmacological activities viz, anti-inflammatory, analgesic, antipyretic, antibacterial and antifungal activities.

**Chapter VII** presents the conclusion and the scope for further research work.